



ENSYN

RTP™ BIO-REFINERY



Sustainable Solutions



Bio-Oil

“The New Crude”

Presentation By:

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Briefing Session Hosted By;



State of New Hampshire

**Governor's Office of
Energy & Community Services**



Jeanne Shaheen
Governor

Northeast Regional Biomass Program

NRBP



August 16, 2002

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Briefing Objectives

Baseline information on:

- 1) status of commercialization of bio-oil production
- 2) products & product markets
- 3) opportunities & challenges facing the industry
- 4) potential role of government

Commercial Summary

- commercial production and sale of bio-oil since 1989
- current annual bio-oil production capacity is in excess of 5 million gallons.
- non energy products sales include food ingredients, food enhancers, and construction material polymers.
- gas, liquid and solid energy products providing process energy through boiler combustion since 1989.
- product development approach parallels petroleum refinery model - bio-oil is treated as a “crude” oil.
- chemicals are isolated, extracted and processed to meet customer specifications.

RTP™ Bio-Refinery - The Technology

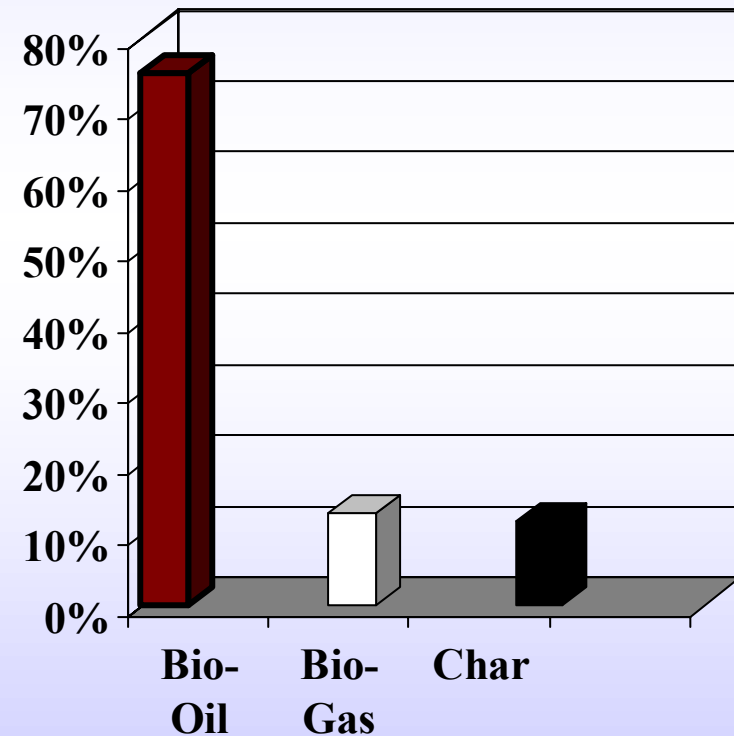
- a very fast heat addition, typically less than one second.
- carbon-based materials exposed to heat in an oxygen-starved environment (no combustion).
- moderate temperatures, atmospheric pressure
- very high heat transfer rates for processing of feedstock and quenching of vapours
- high yields of upgraded liquid products with desirable fuel and chemical properties
- flexibility as to feedstock

RTP™ - Bio-Oil “Crude” Product Yield

Biomass (Wood) Applications: -

current commercial optimums

- high yields of light liquid “bio-oil”, typically 75 wt %
- bio-refinery approach extracts & isolates natural chemicals
- by-product bio-oil applied to heat and power applications
- by-product char value added products or energy
- bio-gas used for process energy or power



Commercial RTP™ Equipment Wisconsin, USA



40 dry TPD

Operating since 1995



45 dry TPD

Operating since 2002

PRODUCT DEVELOPMENT MODEL



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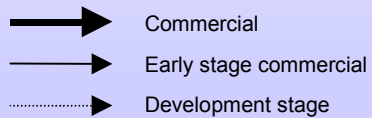
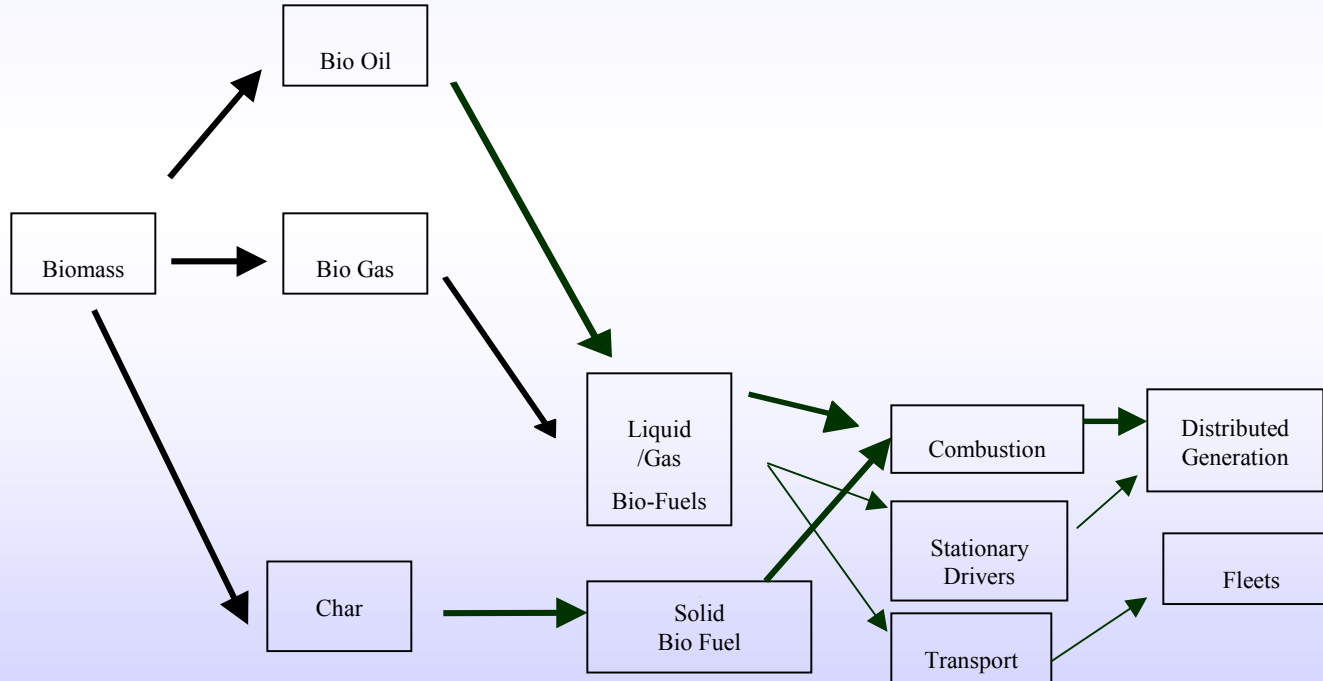
INPUTS

BASIC
BUILDING
BLOCKS

INTERMEDIATES

DERIVATIVES/
APPLICATIONS

CUSTOMERS



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PRODUCT OVERVIEW

Biomass Energy

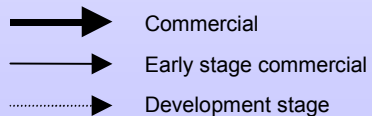
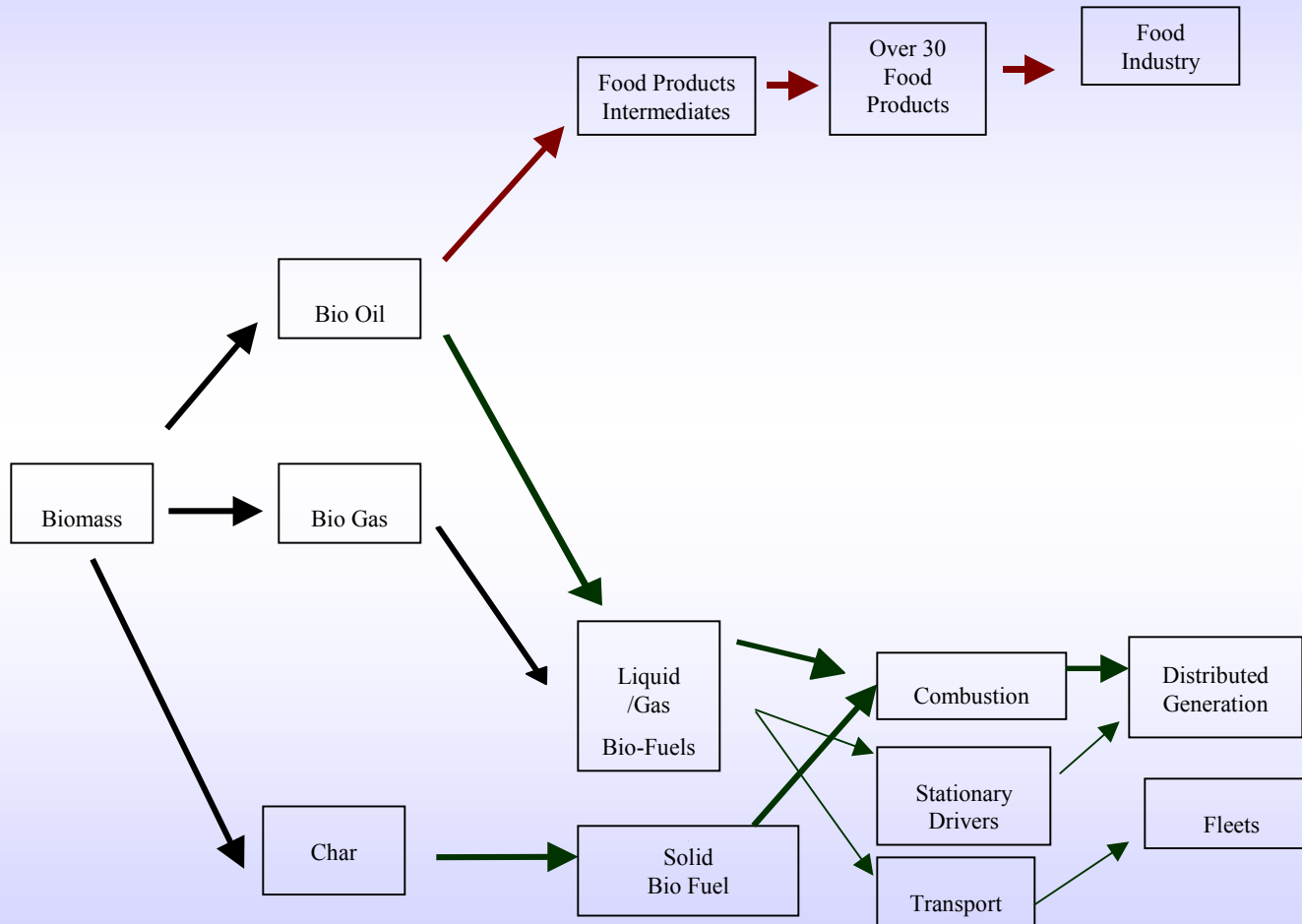
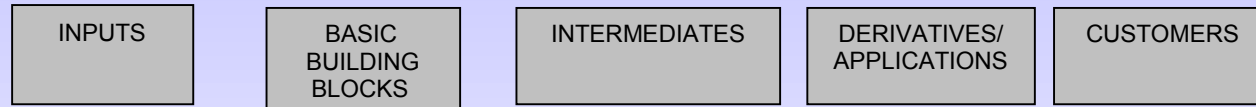


- Gas, liquid & solid fuels produced and consumed since 1989
- process heat & co-generation applications confirmed
- clean burning, CO₂ neutral, no sulphur, minor NOx
- benefits of co-firing
- conventional storage & transportation
- peak power demand firing

PRODUCT DEVELOPMENT MODEL



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PRODUCT OVERVIEW

Food Products & Intermediates



Food Flavoring

- a core product since 1989.
- strategic relationship with major company
- Additional, proprietary feedstocks and bio-refined fractions
- bio-refinery process establishes competitive difference and commercial success

PRODUCT OVERVIEW

Natural Resins & Other Polymers

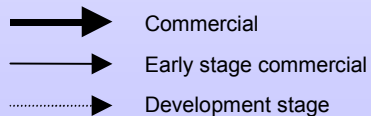
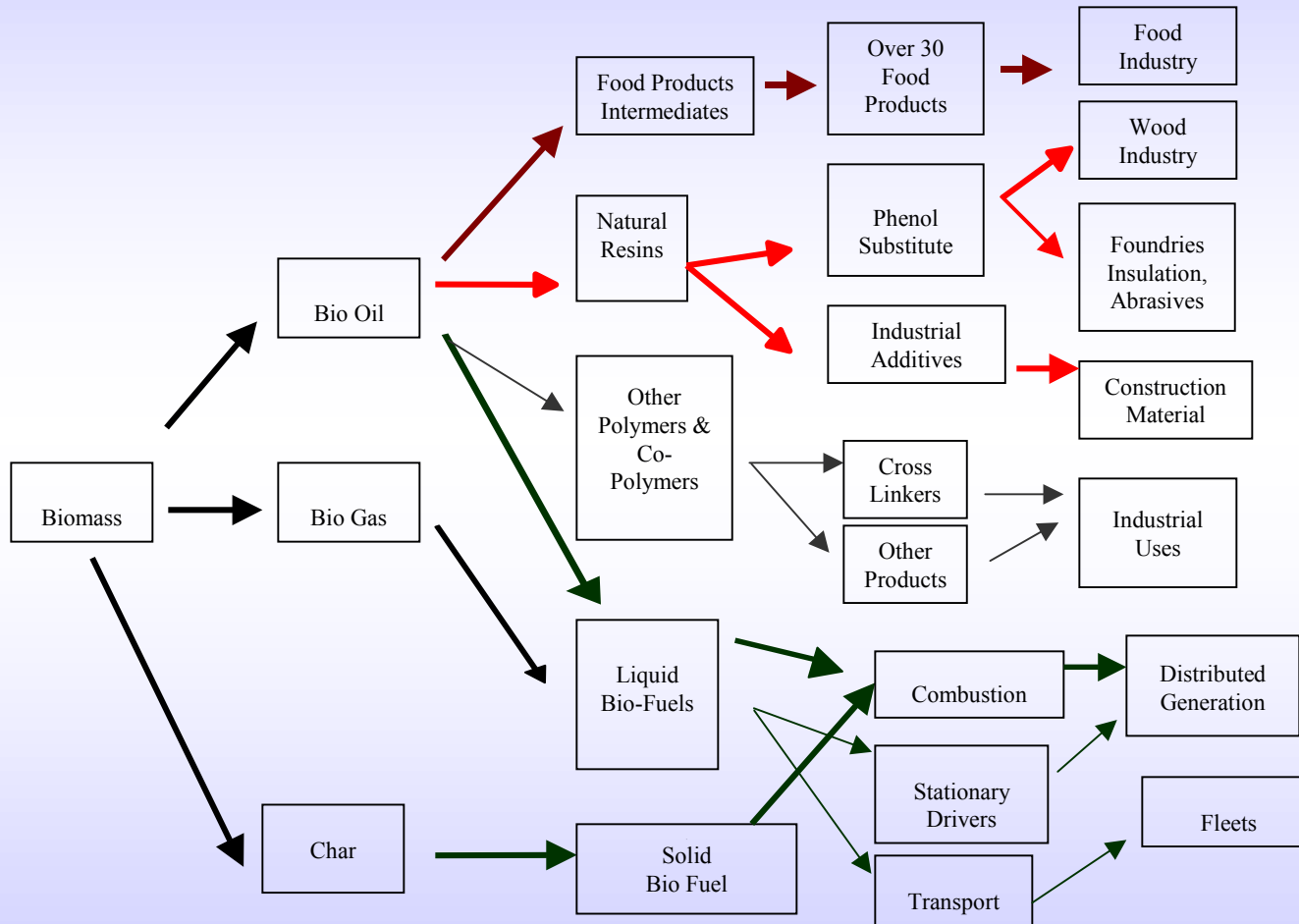
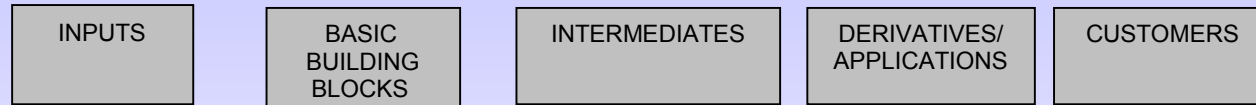


- **binders and elasticizer - additives used to enhance durability of non wood building materials**
- **extensive development work on phenol substitution in PF resin.**
- **natural resin formula's now meet or exceed control standards - commercial mill trials**
- **new feedstocks - new products**
- **cross-linkers have been isolated leading to commercial samples**

PRODUCT DEVELOPMENT MODEL



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PRODUCT OVERVIEW

Carbon & Activated Carbon

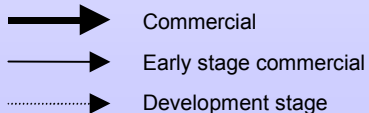
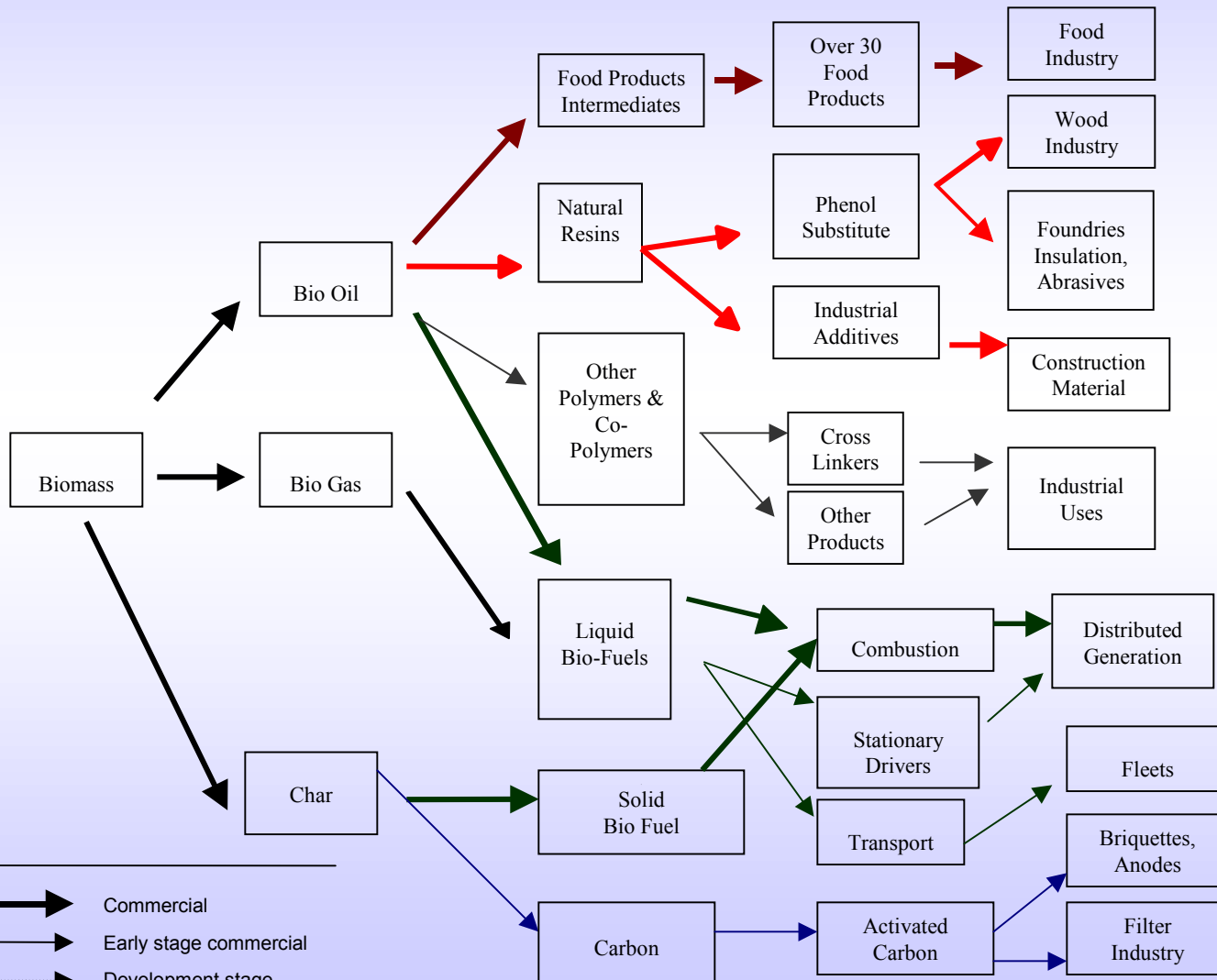
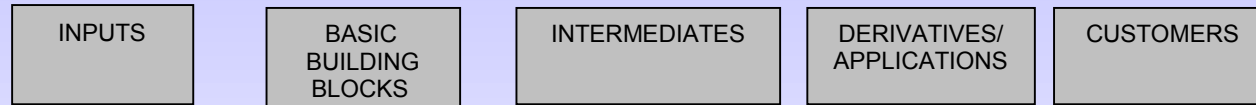
- carbon yield of 12 % - High energy value - 13,500 btu/lbs - Energy alternative
- applications displace carbon from coal
- activated carbon of high quality - process integration with RTP
- tailored products being developed
- **commercial quantities of products requested**



PRODUCT DEVELOPMENT MODEL



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Opportunities & Challenges

Opportunities

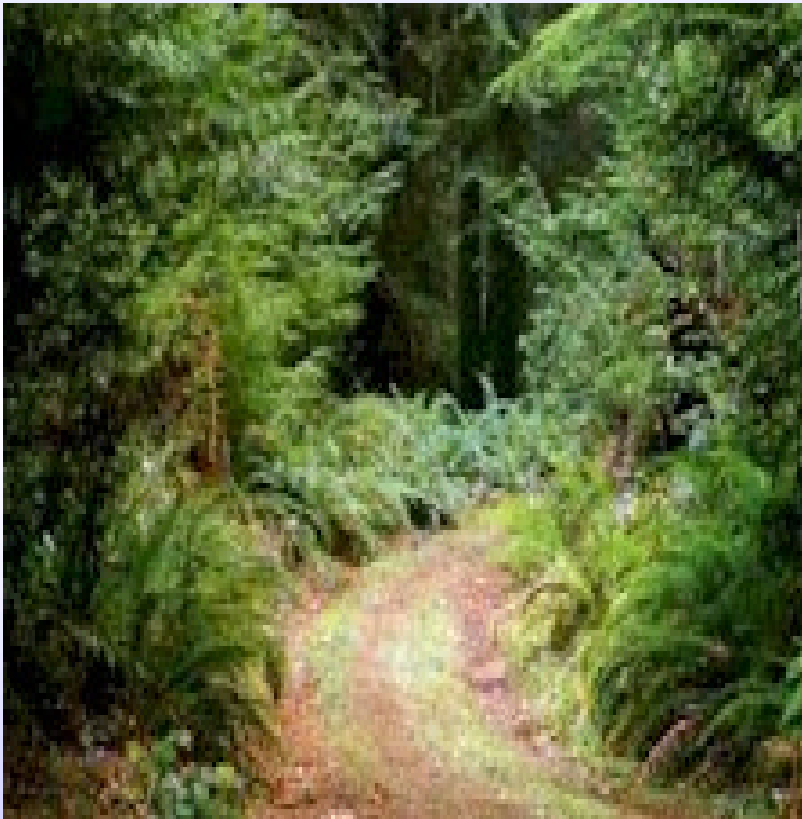
- interest and availability of partners - strategic/public
- global momentum for bio-based energy & products
- abundant bio-feedstock
- technology advancements
- environmental and economic drivers coinciding

Challenges

- interest and availability of partners
- industrial acceptance (product risk profile)
- competitive pricing to traditional products
- initial production & delivery hurdles
- intellectual property



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Thank You